NUEXCO
FUEL POLICY MODEL

Nuexco has developed a model to aid utilities in managing the procurement of U_3O_8 and related services in the front end of the nuclear fuel cycle. The model considers the future price relationships of uranium in its various forms, such as U_3O_8, UF_6 and low enriched uranium (LEU). Given a utility's unique financial and physical constraints and a set of projected market prices, the model is used to determine the optimum policy of acquisition of these commodities and for the management of the out-of-core fuel inventory.

Called the Nuexco Fuel Policy Model, it is a specific application of linear programming to the issues of multi-year planning for nuclear fuel inventory management. Briefly, it permits the planner to consider both the present prices and future price forecasts of U_3O_8, related fuel services and interest rates. Different utility policies, such as allowable market activities and desired inventory levels can be incorporated, as well as the desired utility's forecast of demand for fuel throughout a given planning period. In the Nuexco Fuel Policy Model, the amount of fuel required in any period is specified, with certain resources on hand or available in the market. The problem is to allocate the available resources to meet fuel demands in the most economical way.

The fuel policy model consists of two submodels: the *Arbitrage* model and the *Linear Program*. The Arbitrage model is a network optimization system which determines the least cost path between two defined endpoints for a four commodity network which includes cash, U_3O_8, UF_6, and enriched uranium. As an example, given a starting point of "UF_6 on hand in 1984" and an ending point of "UF_6 on hand in 1990," in each year the Arbitrage model considers the alternatives of holding UF_6, performing a deconversion swap and holding U_3O_8, or selling UF_6 for cash and holding cash (with subsequent purchase in a later year). The Arbitrage model can be used separately to analyze simple decisions. It is also used to derive input for the Linear Program.

The Linear Program is a technique for solving a general class of optimization problems dealing with the interaction of many *decision variables* which are subject to certain restricting conditions. In solving these problems, an *objective function* such as the minimum cost of nuclear fuel is obtained in the best fashion, subject to *constraints*.

For the case of nuclear fuel management, the objective function is defined as the minimum fuel cost to the ratepayers over a period of time. The decision variables are the amounts of uranium, conversion, and enrichment to be purchased, held, loaned, sold, etc., in each year. Typical constraints are limits to financial resources, fuel demand in certain periods, and minimum inventories.

The linear programming technique also furnishes sensitivity information, providing the limits on the constraints for which the optimum solution will remain in effect. This information allows the resource manager insight on how much limits such as cash flow can be reduced without increasing fuel costs.

The linear programming technique used solves the "dual problem." When the optimum solution is constrained, the dual program generates "shadow costs," i.e., the potential for additional cost reduction if additional resources were available. For inventory management, these shadow costs quantify the costs of constraining cash flow or credit.

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EXECUTIVE SUMMARY
REPORT 191
(All data as of June 30, 1984)

Exchange Value
$17.50, down $0.25

The **Exchange Value** is **$17.50** per pound U_3O_8, down $0.25 since last month. Four recent transactions are reported, two involving concentrates and two natural UF_6.

Supply-Demand Ratio
unchanged at 2.2:1

Active spot and near-term **uranium supply** amounts to **4.3 million** pounds U_3O_8 equivalent, down 900 thousand pounds from last month. Active spot and near-term **uranium demand** totals **1.9 million** pounds, down 500 thousand pounds. The spot and near-term **supply-demand ratio** remained at **2.2:1.**

Transaction Value
fell $0.50, to $16.50

The **Transaction Value** is **$16.50** per pound U_3O_8, down $0.50 since last month. It includes 18 transactions involving a total of 5.4 million pounds U_3O_8 and equivalent UF_6 and covers a period of 4 months.

Loan Use Charge Rate
unchanged at 6%

The **Loan Use Charge Rate** remains **6 percent** per annum.

Conversion Value
dropped to zero

The **Conversion Value** is **$0.00** (zero) per pound U as UF_6, down $0.80 since last month. No secondary market conversion transactions are reported. Active secondary market supply of conversion services for delivery within three years totals 2.8 million pounds U as UF_6. For the third month in a row, no active demand is reported.

SWU Values
$95 for DOE-origin (FY85)
$80 for non-DOE origin
(delivery within 15 months)

The **SWU Values** are **$95** per SWU of DOE origin and FY85 delivery, down $10 since last month, and **$80** per SWU of non-DOE origin, unchanged. No SWU transactions are reported. Active secondary market SWU supply amounts to 405 thousand SWUs, while active demand totals 175 thousand SWUs.

Commentary

Nuexco's chairman, Mr. J.R. Wolcott, presents his views on the role of the US Department of Energy in the enrichment services market.

Basic Considerations

The Urenco group is steadily expanding its low-cost centrifuge enrichment operations, and actively seeks outside business to fulfill its long-term plans for growth.

Japan

A site has been proposed for location of commercial enrichment, waste storage, and reprocessing facilities. Nuclear power generated a disproportionately high share of electricity in FY83, and operating plants set a record for average capacity factor.

Central Africa

Uranium production from three uranium projects in Gabon and Niger totalled 11.5 million pounds U_3O_8 in 1983. Some reduction of output appears likely this year in Niger.

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NUEXCO REPORT 191 FIGURES OF THE MONTH (June 30, 1984)	This Month (Report 191)	Last Month (Report 190)	12 Months Ago (Report 179)
Exchange Value[1]	17.50	17.75	23.50
Transaction Value[1]	16.50	17.00	22.45
Conversion Value[2]	0.00	0.80	1.20
Loan Use Charge Rate[3]	6%	6%	6%
Near-Term Uranium Supply[4]	4.3	5.2	6.0
Near-Term Uranium Demand[5]	1.9	2.4	2.3
Near-Term Supply-Demand Ratio	2.2	2.2	2.6
Recent Uranium Sales:			
Number of Transactions[6]	4	9	4
Quantity of Material[7]	5.8	3.5	1.3-3.7
Nuexco SWU Values:[8]			
DOE origin, FY85 delivery	95	105	—
non-DOE origin, delivery within 15 months	80	80	—
USDOE SWU Prices:			
USEC	135.00	135.00	—
AFC	153.00[9]	153.00[9]	138.65
Requirements	157.00[9]	157.00[9]	149.85
Market Value of Enriched UF_6[10, 11]:			
2.5 w/o U_{235}	512.54	555.72	619.44
3.0 w/o U_{235}	659.57	715.89	792.80
3.5 w/o U_{235}	809.59	879.36	969.24
4.0 w/o U_{235}	961.65	1,045.09	1,147.96

[1] US $ per pound U_3O_8 equivalent.
[2] US $ per pound U as UF_6.
[3] Per annum.
[4] Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8).
[5] Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8).
[6] Uranium sales only; does not include loans, conversion, or SWU transactions.
[7] Millions of pounds U_3O_8 equivalent.
[8] US $ per SWU.
[9] Effective 10/1/84.
[10] Calculated using the Nuexco Exchange Value, Conversion Value, and 0.20 percent tails assay. From 2/28/83 through 9/30/83, calculations used the Nuexco SWU Value for the relevant fiscal year. From 10/31/83 through 2/29/84, calculations used the Nuexco SWU Value for DOE origin and FY84 delivery. As of 3/31/84, calculations use the Nuexco SWU Value for DOE origin and FY85 delivery.
[11] US $ per KgU as UF_6.

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